

# Reply to Johansen's comment

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Our paper [1] contained a series of comments on the claims that were then made about possible log-period precursors to financial crashes. We felt in particular that a seven parameter fit of noisy data, without any theoretical guidance, was dangerous; that the core of such a spectacular effect, i.e. the geometrical acceleration of the periods of the oscillations should, if present, be visible to the naked eye. We expressed doubts about the very nature of the prediction: log periodic singularities are interesting if there *is* a singularity such as a *sudden* drop of price, but in many examples, the observed crash occurs before the predicted singularity (as in November 1997 [1]), or actually does not occur as a sudden crash but as a smooth drawdown, as now argued by Johansen [2] for the JGB (Japanese Government Bonds) in 1995. The mechanism that would lead to such a variety of scenarios, and still preserve to a 'log periodic' signal with no singularity, would be, to say the least, non standard.

The situation has evolved in the recent years. More statistical tests and evidence were presented by Johansen and Sornette (JS) [3]. Interestingly, the parameter governing the acceleration of the oscillations was found to be rather constant across many different crashes. However, strong and well documented criticisms were also expressed by Feigenbaum in two papers [4] that are, sadly, rarely cited by JS.

Finally, in [1], we reported a rather anecdotal event, that we felt relevant because it was at the time a real *prediction*, rather than a 'post-diction'. As we argued then, the failure of a prediction does not prove the theory to be wrong. Our point, however, was that *both* failures and success should have been systematically reported. The two specific points of the authors comment concern (i) the predicted date of the crash of the JGB in 1995 and (ii) a discussion about whether or not the crash did actually happen. About point (i), the author is perfectly right. We have found the precise date of the trades reported in [1], that start on the 13th of July 1995. As we wrote in [1], this prediction was first reported to us in May, but the prediction was indeed for August, and obviously not for May itself, as we mistakenly wrote. About point (ii), the argument of Johansen is that although the JGB did not "crash" in August 1995, its subsequent drawdown can

be seen as a crash, thereby validating a posteriori the log-periodic scenario, since its amplitude is “large” – in particular for a bond contract, “less volatile” than stock markets. That the decline is ‘large’ is inferred from the fact that its amplitude lies above the extrapolation of an ad-hoc stretched exponential fit of the distribution of “normal” events. However, there is no convincing theoretical model underpinning this particular functional form. On the contrary, both precise empirical studies [5] and recent rather successful theoretical models [6] suggest a much fatter, power-law tail, for which the observed drawdown would not stand as an outlier. We furthermore note that bond markets *do* crash in a usual sense: for example, on October 8 and 9, 1998 the (December) Bund futures lost respectively 1.96 and 1.53 point, a 6.7 and a 5.2 sigma event (as measured by the historical volatility since 1997). These numbers are comparable to the worst crashes of the last ten years on the S&P 500, Aug 31 1998 and Nov 27 1997, two 6-sigma events. It can also be seen on Johansen’s Fig. 1 that the amplitude of the drawdown is actually less than the amplitude of the ‘draw-up’ that occurred just before. Should there then be log-periodic oscillations before this draw-up?

Finally, we would like to remind Johansen that ‘put’ options are worth nothing if the contract is above the exercise price at maturity. Delicate trading *was* necessary, not because the JGB dropped, but precisely because a crash in the usual sense did not occur.

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